

SELF-POWERED FITNESS EQUIPMENT

FIELD OF THE INVENTION

10 The present invention relates to exercise equipment, and more specifically to a self-powered stationary exercise device including a storage battery for actuating certain components of the exercise device so as to maintain the resistance felt by the user substantially constant during the device's use.

BACKGROUND OF THE INVENTION

10 A stationary exercise device that can simulate a wide range of stepping motions, including skiing, walking, jogging, running and climbing, is known under the trademark of EFX Elliptical Fitness Crosstraining® and is available from Precor Incorporated of Bothell, Washington. Some embodiments of Elliptical Fitness Crosstraining® machines are described in U.S. Patent No. 6,146,313, which is explicitly incorporated by reference herein.

15 Briefly, referring to FIGURE 1, an Elliptical Fitness Crosstraining® machine includes a floor engaging frame 10 incorporating a forward post 12. A pair of flywheels 14a and 14b (overlapping with each other and thus only flywheel 14a is shown) are located at the rear of the frame 10 for rotation about a horizontal, transverse axis 16. The rearward ends of foot links 18a and 18b are pivotally attached to corresponding
20 flywheels 14a and 14b to travel about a circular path around axis 16 as the flywheels rotate. The forward ends of foot links 18a and 18b are movably mounted to an adjustable guide 20. The forward ends of foot links 18a and 18b are adapted to ride along guide 20, to reciprocate back and forth therealong, as the rearward ends of foot links 18a and 18b rotate about axis 16, causing foot pedals (or foot supports) 22a and 22b carried by the
25 foot links to travel along various elliptical paths. Specifically, FIGURE 1 shows the path

of travel of the foot pedal at three different angular orientations of guide 20 corresponding to different elevations of a lift system 24. In the smallest angular orientation (approximately 10° above the horizontal), the corresponding foot pedal travel path 26 is illustrated. This generally corresponds to a gliding or cross-country skiing motion. The guide 20 is shown at a second orientation at a steeper angle, approximately 20° from the horizontal, with the corresponding foot pedal travel path 28. This path of travel generally corresponds to a walking motion. FIGURE 1 also illustrates a third, even steeper, angular orientation of the guide 20, approximately 30° from the horizontal, with the corresponding foot pedal travel path 30. This path of travel generally corresponds to a climbing motion. Additionally or alternatively to changing the angular orientation of guide 20, changing the elevation of guide 20 relative to the frame 10 will also cause the path of travel of the foot pedals to change. The Elliptical Fitness Crosstraining® machine of this type is connectable to a standard amperage AC power supply.

SUMMARY OF THE INVENTION

The present invention is directed to providing self-powered fitness equipment, such as a self-powered Elliptical Fitness Crosstraining® machine.

Specifically, a self-powered fitness device to simulate various types of stepping motions is provided. The device includes a frame, a guide movably associated with the frame, and at least one foot support coupled to the guide. The foot support is configured to receive a user's feet. The device further includes a generator drivably coupled to the foot support. The generator is activated to produce power by the user's stepping motions on the foot support. The device also includes a battery coupled to the generator to store at least part of the power produced by the generator. Finally, the device includes a lift system for automatically changing at least one of the elevation and the angular orientation of the guide relative to the frame. Since the lift system is powered by both the generator and the battery, actuation of the lift system will not alter the resistance to the user pedaling the foot support during exercising.

In accordance with one aspect of the present invention, the device may be configured so that the battery will power the device for a predefined period of time even after the user stops pedaling.

As will be apparent to those skilled in the art, the use of a battery to activate an actuator (e.g., a lift system) of a fitness device so as to maintain a substantially constant

resistance to the user can be applied in various types of fitness equipment, and is not limited to an Elliptical Fitness Crosstraining® machine.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and many of the attendant advantages of this invention will become more readily appreciated as the same become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a side elevational view of an Elliptical Fitness Crosstraining® machine shown in schematic form, illustrating the paths of the user's foot at different angular orientations of a guide for foot pedals, as known in the prior art;

FIGURE 2 is a perspective view of a self-powered Elliptical Fitness Crosstraining® machine formed in accordance with the present invention; and

FIGURE 3 is a block diagram illustrating electrical components of the self-powered Elliptical Fitness Crosstraining® machine formed in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGURE 2, a self-powered fitness device to simulate various types of stepping motions in accordance with the present invention includes a frame 10, a guide 20 movably associated with the frame, and a pair of foot pedals (foot supports) 22a and 22b carried by elongated foot links 18a and 18b. The forward ends of the foot links 18a and 18b are movably supported by the guide 20. The device further includes a lift system 24 (enclosed in a forward hood 25) for selectively and automatically changing at least one of the elevation and angular orientation of the guide 20 relative to the frame 10. Thus, the user may readily adjust the guide 20 to simulate a wide range of stepping motions. These components are generally equivalent to those disclosed in U.S. Patent No. 6,146,313 referred to in the background section above.

Referring additionally to FIGURE 3, in accordance with the present invention, the self-powered fitness device still further includes a generator 32 (enclosed in a rearward hood 34) drivably coupled to the first and second foot links 18a and 18b. The generator 32 is actuated to produce power by the user's stepping motions when the user's feet are in the first and second foot pedals 22a and 22b. In one embodiment, the generator 32 is formed of a three-phase AC generator including a DC permanent-magnet

alternator, which produces a sinusoidal voltage proportional to its rotational speed (RPM). To actuate the generator 32 by the user's stepping motions, the generator is drivably coupled with the flywheels 14a and 14b coupled to the foot links 18a and 18b (see FIGURE 1) using any suitable transmission means such as a shaft, chain, transmission, or belt (not shown). The generator 32 is designed so as to produce a voltage even when a user is pedaling at very low speeds. The resistance on the pedals for the user is controlled by a resistance controller 36 based on the amount of current being demanded from the generator 32, i.e., the more current is demanded from the generator 32, the higher the level of torque required to power the generator 32, and the higher the resistance on the pedals. For example, this can be accomplished by a CPU/microprocessor 60 determining the amount of current being demanded from the generator 60, and sending a corresponding command signal to the resistance controller 36. The resistance controller 36 responds by sending a corresponding field current signal (e.g., pulse width modulated signal) to the generator 32. Changes in the field current signal varies the field current in the alternator in the generator 32, i.e., increasing current in the alternator field tends to increase the strength of its magnetic field, thereby increasing resistance of the alternator to the user; and decreasing current in the alternator field tends to decrease the strength of its magnetic field, thereby decreasing resistance of the alternator to the user. The field current signal may be varied by the user's programming for imparting a desired level of resistance to the user. The voltage produced by the generator 32 is used to power various components of the self-powered fitness device, as will be more fully described below.

This arrangement, without more, would require that whenever substantially more current is demanded from the generator 32, for the purpose of actuating the guide 20 in this example, the resistance on the pedals for the user will be increased. This is undesirable when the user wishes to continue exercising while maintaining a substantially constant resistance to his/her stepping motions.

Accordingly, still referring to FIGURE 3, the present invention provides a novel arrangement of a battery 48 to actuate the lift system 24 to move the guide 20 up and down, so as to maintain the resistance to the user substantially constant during exercising regardless of whether the guide 20 is activated or not. Specifically, according to the present invention, the voltage from the generator 32 is rectified and converted into DC

1009047.030102

voltage via an AC-DC converter 38, which will then power a universal power supply 40. The universal power supply 40 will create an isolated power supply 42 (for example, 18 volts) and a non-isolated power supply 44 (for example, 12 volts). For safety regulations purposes, the 18-volt isolated power supply 42 is connected to a digital ground, which is
5 isolated from the non-isolated power supply 44 connected to an analog ground, to completely isolate those components that may contact the user from any circuits powered directly from the AC generator 32 (see "isolation barrier" line in FIGURE 3). The non-isolated power supply 44 is used to operate the resistance controller 36.

In one embodiment, the 18-volt isolated power supply 42 is then converted into
10 14.5 volts for a battery charger 46 for charging the battery 48, which will be used to power the DC guide lift motor (actuator) 24 to move the guide 20 up and down, under the control of a lift controller 52. In place of a conventional battery, any type of electric energy storage medium may be used, as will be apparent to those skilled in the art. The isolated power supply 42 is also converted into 8 volts via a DC-DC converter 54 to
15 power a display panel 56 of the fitness device. (See FIGURE 2, also.) As well known in the art, the display 56 includes one or more display screens and a command console composed of a number of depressible buttons. The display screens are used for presenting various information useful to the user, while the command console is used to allow the user to activate or program the device. The 8 volts from the DC-DC converter
20 54 is further converted to 5 volts via a linear regulator 56 for powering a CPU and other peripherals 60. The CPU 60 coordinates the operation of the lift controller 52, the upper display 56, and the resistance controller 36.

Importantly, because the battery 48 is used to power the guide 20, actuating the guide 20 will not produce a change in the resistance on the pedals 22a and 22b felt by the
25 user (except when the user's programming changes the current being demand from the generator 32). The normal guide duty cycle operation is typically 16.6%, meaning that for each minute that the guide 20 is actuated ("on"), there will be 5 minutes that the guide 20 is not actuated ("off"). Accordingly, the battery 48 is configured to be charged during the "off" cycle, and then, during the "on" cycle, the 14.5 volts from the battery charger 46
30 supplies some of the current for actuating the guide 20 while the battery 48 will provide the rest. Consequently, while the user is pedaling, the whole system is powered using solely the energy provided by the user, and the resistance on the pedals will not change

even when the guide 20 is actuated. Furthermore, the battery 48 may be used to power the guide 20, and also maintain the CPU 60 and the display panel 56, for up to 20-30 seconds after the user stops pedaling.

While the preferred embodiments of the invention have been illustrated and described, it will be appreciated that various changes can be made therein without departing from the spirit and scope of the invention. For example, while the self-powered fitness device of the present invention was described in specific reference to a Elliptical Fitness Crosstraining® machine of the type described in U.S. Patent No. 6,146,313, the invention may be incorporated in other types of self-powered fitness devices with an actuable component (e.g., a guide) in order to maintain the resistance for the user substantially constant regardless of actuation of the component. Thus, any device wherein a user may translate exercise of any portion of the body into electric power via a generator (e.g., rowing machines, treadmills, stair climbers, weight machines, exercise cycles, etc.) can incorporate the present invention.